



Department of Defense Fuel Spending, Supply, Acquisition, and Policy

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Summary

Department of Defense (DOD) fuel consumption varies from year to year in response to changes in mission and the tempo of operations. DOD may consume upwards of 1% of the petroleum products refined in the United States annually. Petroleum products purchased and consumed overseas may double DOD's consumption. The majority of DOD's bulk fuel purchases are for jet fuel, which has ranged as high as 101 million barrels annually in the past decade. The U.S. refining industry has been supplying 50% of the jet fuel demand. DOD has consumed as much as 145 million barrels in overall petroleum products annually.

In FY2000, fuel costs represented 1.2% of the total DOD spending, but by FY2008 fuel costs had risen to 3.0%. Over the same time, total defense spending had more than doubled, but fuel costs increased nearly 500%. Prices paid for military specification JP-8 and JP-5 jet fuel have exceeded the price of commercial equivalent fuel. In a recent move to contain fuel costs, DOD has begun substituting commercial grade jet fuel for some of its purchases, and upgraded the fuel to military-specification.

Currently, 141 refineries operate in the United States. DOD's top four fuel suppliers operate a combined 31 refineries in the United States, which represents nearly 6 million barrels per day of crude oil distillation capacity. A typical U.S. refinery yields a limited supply of jet and diesel fuel depending on the type of crude oil processed. Gulf Coast (Texas and Louisiana) refineries yield up to 8% jet fuel. Generally, refineries are set up to run specific grades of crude oil, for example light sweet crude or heavy sour crude. Light sweet crude is particularly desirable as a feedstock for gasoline refining because its lighter-weight hydrocarbons make it easier to refine. Heavier crude oils require more complex processing than light crudes, and sour crudes require desulfurization. Changing crude oil supplies have consequently forced refineries to upgrade their processes (thus increase refinery complexity) to handle heavier sour crude oils. At the same time, the Environmental Protection Agency (EPA) has taken action to require lower sulfur content of diesel fuel, and has proposed a final rule that will require refineries to report their greenhouse gas emissions as a prelude to expected legislation that will limit emissions.

The Defense Energy Support Center (DESC), which falls under the Defense Logistics Agency, has the mission of purchasing fuel for all of DOD's services and agencies. In practice, DESC has typically awarded fuel contracts for lengths of one year, but there are other buying programs with longer contract periods. DESC uses fixed-price contracts with economic price adjustments. These adjustments provide for upward and downward revision of the stated contract price upon the occurrence of specified contingencies. DESC has determined that supplies and related services are eligible for the multi-year contracting provisions under the Federal Acquisition Regulation, and has adopted contracting instructions for entering into multiyear contracts. Bulk petroleum contracts and direct delivery fuel contracts are likely to remain one-year contracts, however.

DESC bases contract delivery price on the lowest cost to the government; however, the hidden logistical cost born by operational commands moving the fuel to their area of operations may not be fully accounted. The acquisition process for new military capabilities now requires that DOD account for fuel logistics when evaluating lifecycle costs.

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Background

Department of Defense (DOD) fuel consumption varies from year to year in response to changes in mission and the tempo of operations. DOD may consume upwards of 1% of the petroleum products annually refined in the United States. Foreign purchased petroleum products may double DOD's consumption.

The Defense Energy Support Center (DESC), under the command of the Defense Logistics Agency (DLA), has the mission of purchasing fuel for all of DOD's services and agencies, both in the continental United States (CONUS) and outside (OCONUS). DESC's origins date back to World War II, when the Army-Navy Petroleum Board fell under the Department of the Interior. Its mission transferred to the War Department in 1945 and its designation changed to the Joint Army-Navy Purchasing Agency. In 1962, the agency became a part of the former Defense Supply Agency, now known as the Defense Logistics Agency (DLA). Designated the Defense Fuel Supply Center (DFSC) in 1964, it served as a single entity to purchase and manage the DOD's petroleum products and coal. In 1998, it was re-designated the Defense Energy Support Center with an expanded new mission to manage a comprehensive portfolio of energy products.¹

In practice, DESC typically awards fuel contracts based on the lowest cost to the point of delivery, typically for lengths of one year. DESC's fuel procurement categories include bulk petroleum products (JP-8, JP-5, and diesel fuel), ships' bunker fuel, into-plane (refueling at commercial airports), and post-camp-and-station (PC&S).² Although DOD may represent the single largest consumer of petroleum products, its consumption primarily of JP-8, JP-5, and diesel fuel aligns more closely with the narrower market for middle-distillate fuels.³

This report summarizes DOD's fuel purchases over the current decade (FY2000 through FY2008); and compares fuel spending to overall DOD spending. It also compares the prices that DOD pays for fuel to commercially equivalent fuel, and the quantities of DOD fuel purchases to the net production of U.S. refined petroleum products. To place DOD's fuel requirement in a larger perspective, the report discusses refining and refineries supplying DOD's jet fuel, and DESC's fuel procurement practices. The report concludes by discussing recent legislation and policies that affect fuel procurement.

In the past, when crude oil and refined petroleum prices were high, Congress has looked at DOD's fuel demand as a means of stimulating private sector interest in producing alternative fuels. Recent legislation directs DOD to consider using alternative fuels to meet its needs, and to stimulate commercial interest in supplying the needs. Recent high fuel prices did stimulate DOD and private interest in producing alternative fuels from coal and oil shale, though no project has yet reached commercial operation. Legislation ensuring that federal agencies do not spend taxpayer dollars on new fuel sources that will exacerbate global warming now counters earlier policy objectives. Proposed rules that mandate greenhouse gas emission reporting may minimally affect refineries. Recently introduced legislation that would cap greenhouse gas emissions is

¹ See <http://www.desc.dla.mil/DCM/DCMPage.asp?LinkID=DESHISTORY>.

² See **Appendix** for definition of terms and description of fuels.

³ The complete product categories include avgas, distillates & diesel, gasohol, JP-4, JAB, JAA, JA1, JP-5, JP-8, lube oils, mogas, and bunker fuel.

likely to affect some refinery operations, if not the refining industry's responsiveness to DOD's fuel requirements.

Fuel Purchases

DOD's fuel consumption varies from year to year in response to changes in mission and the tempo of operations. The majority of DESC's bulk fuel purchases are for JP-8 jet fuel, which has ranged from 60 to 74 million barrels annually over the past decade (the equivalent of 165,000 to 200,000 barrels per day). The Air Force and the Army represent the primary consumers of JP-8 fuel. The Navy consumes JP-5 jet fuel. All services to varying degrees consume diesel fuel.

DESC's total fuel purchases peaked at 145.1 million barrels in FY2003, when U.S. forces invaded Iraq. JP-8 purchases peaked in FY2004 and have since been declining (as discussed further below). In FY2000, JP-8 represented almost 60% of overall DESC's overall purchases and by FY2008 only 46%.

Overall DESC fuel expenditures grew from roughly \$3.6 billion in FY2000 to nearly \$18 billion by FY2008—a nearly 500% increase. Actual volumes purchased had only increased by 30% over the same time. DESC petroleum product purchases, summarized by volume and total cost, appear in **Table 1**.

Table 1. DESC Fuel Product Purchased by Category
(Million Barrels per Year)

	FY2000	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	FY2007	FY2008
JP-8	61.7	63.4	73.5	72.2	74.7	71.4	71.3	68.2	62.5
JP-5	15.4	18.6	20.6	17.9	16.1	12.8	14.4	13.6	12.1
Alt. Jet	0.1	0.2	8.7	11.3	5.4	9.3	15.6	19.3	23.1
Jet total	77.2	82.2	102.8	101.4	96.2	93.5	101.3	101.1	97.7
Diesel	15.5	20.8	21.6	25.2	21.0	21.2	22.1	22.8	24.5
Other	11.4	8.0	10.2	18.5	27.6	16.0	12.5	12.2	12.7
Total	104.1	111.0	134.6	145.1	144.8	130.7	135.9	136.1	134.9
\$ Million	3,604	4,178	4,143	5,564	6,948	8,843	11,504	11,465	17,944

Source: DESC, *Fact Books (FY1997 through FY2007)*, <http://www.desc.dla.mil/DCM/DCMPage.asp?PageID=721>;

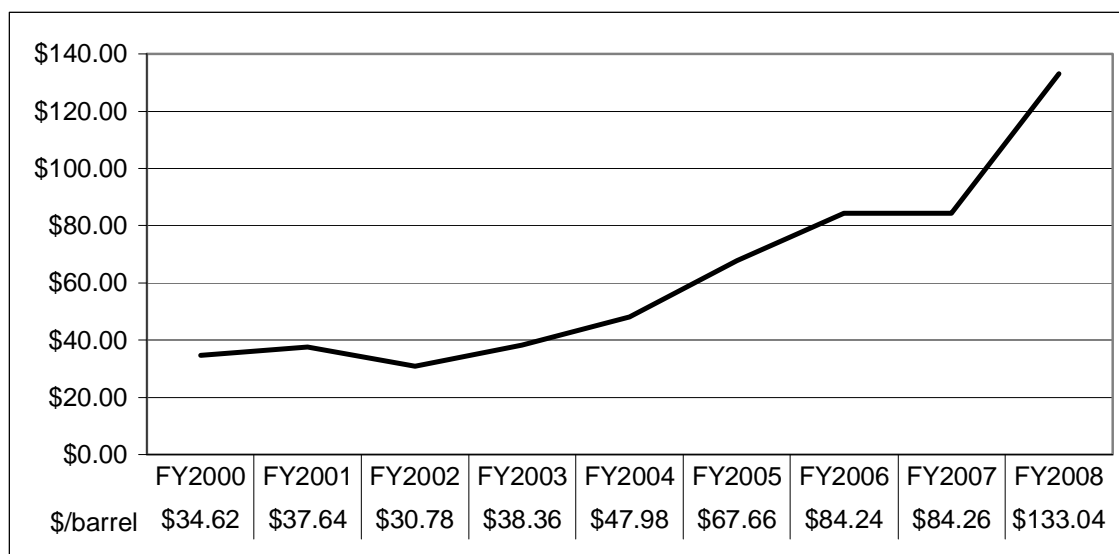
Notes: Alt. Jet (alternative jet fuels) includes Jet A, Jet A-1, Jet B, and JP-4; see glossary for description. Other includes lube oils, mogas and residuals), into-plane, post-camp-and-station, and ship's bunker.

DESC's purchases, however, do not necessarily correspond with DOD's actual consumption. DESC may draw fuel down from storage to supplement demand and may replenish fuel stores

with purchases. DOD also maintains a fuel “war reserve” that it may draw down in contingencies.⁴

While DOD’s full consumption began leveling off after the Iraq war, fuel costs and average fuel prices continued increasing; in part, from increasing crude oil prices (which spiked to nearly \$140 per barrel in the summer of 2008) and, in part, from increasing refining margins (discussed below). The average cost of all petroleum products purchased rose from \$34.62 per barrel in FY2000 to over \$133 per barrel in FY2008; an increase of nearly 370% (see **Figure 1**).

Figure 1. Average Cost of All DESC Purchased Petroleum Products



Source: DESC, Fact Books (FY1997 through FY2007).

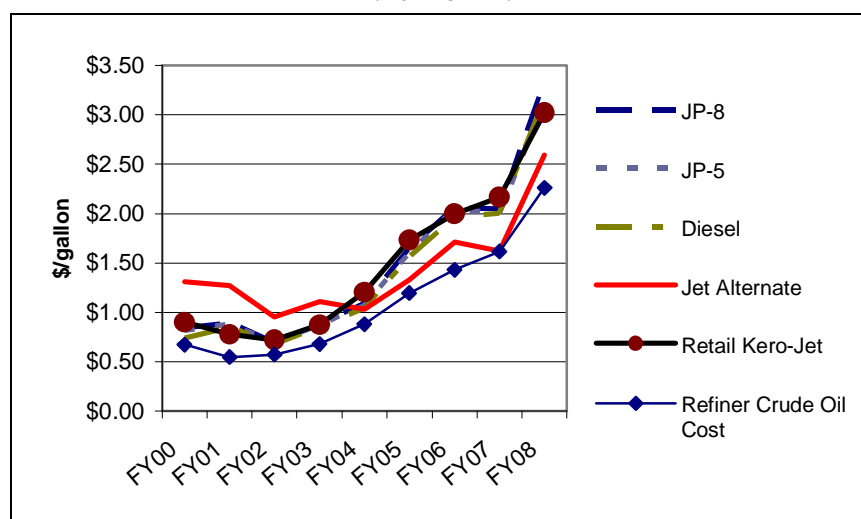
DOD Fuel Cost vs. Commercial Fuel Price

Earlier, JP-8 and JP-5 jet fuels held a comparative price advantage over their commercial equivalent — Jet A fuel. With commercial aviation’s setback after September 11, 2001, and the Iraq invasion in 2003, the military jet fuel price-advantages reversed. Jet and diesel fuel prices appear in the graph of **Figure 2** and the summary in **Table 2**. Note that as all fuel-prices increased, the margin between refiners’ crude oil cost and refined product prices also increased; from an average of 15¢/gallon in FY2000 to an average of 91¢/gallon by FY2008.

DOD did respond when refiners offered commercial jet fuel at lower prices than military specification fuel. As shown in **Table 1**, DESC offset decreasing JP-8 purchases with increasing purchases of alternate jet fuels (commercial aviation specification fuels that can substitute for military specification). Diesel fuel purchases also picked up.

⁴ War reserve stocks are classified information.

Figure 2. DOD Fuel Costs vs. Commercial and Crude Oil Price
(\$ per gallon)



Source: DESC Fact Book and U.S. EIA U.S. Crude Oil Composite Acquisition Cost by Refiners (\$/Bbl), http://tonto.eia.doe.gov/dnav/pet/hist/r0000_3a.htm.

Notes: JP-8, JP-5, and diesel represent DOD costs; Jet Alternate includes JP-4, JAA, JAA-I and JAB. Retail Kero-jet represents commercial aviation jet; and Refiner Crude Oil Costs oil represents the average annual cost of acquisition by U.S. refiners. See **Table 2** for cost breakout.

Table 2. DOD Fuels Costs vs. Crude Oil Costs
(\$ per gallon)

	2000	2001	2002	2003	2004	2005	2006	2007	2008
US Jet Retail Sales	0.81	0.88	0.67	0.85	1.07	1.60	2.03	1.99	3.16
JP-8	0.85	0.89	0.70	0.88	1.09	1.66	2.06	2.05	3.33
JP-5	0.82	0.88	0.69	0.87	1.07	1.60	2.05	2.00	3.13
Diesel	0.74	0.85	0.68	0.85	1.04	1.57	1.96	2.00	3.17
Jet Alternates	1.31	1.27	0.95	1.11	1.03	1.33	1.71	1.62	2.59
Average Cost	0.82	0.90	0.73	0.91	1.11	1.61	2.02	2.01	3.14
Refining Margin	0.15	0.35	0.16	0.23	0.23	0.41	0.58	0.39	0.91
Refiner Crude Cost	0.64	0.61	0.52	0.67	0.80	1.12	1.43	1.44	2.42
\$/bbl	26.70	25.80	21.98	28.01	33.65	47.21	59.95	60.62	101.52

Source: Defense Energy Support Service, *Fact Book* (2000 – 2008). Energy Information Administration—*Petroleum Navigator*, *Monthly U.S. Crude Oil Composite Acquisition Cost by Refiners*, and *Monthly U.S. Kerosene-type Jet Fuel Retail Sales by Refiners*.

Notes: Jet Retail represents the retail sales of jet fuel by U.S. refiners averaged over the fiscal years. Prices are normally reported in cents per gallon, but have been converted to dollars per gallon.

Refiner Crude Oil Costs represent the refiners cost for acquiring crude oil averaged over the fiscal year. Crude oil costs are typically reported in terms of \$/barrel, but for the purpose of this table, the cost has been converted to \$/gallon. One barrel (bbl) is equivalent to 42 gallons (gal).

DESC Fuel Cost vs. DOD Outlays

Outlays represent cash payments made to liquidate the government's obligations in a fiscal year. The obligations may be incurred over a number of years as there is a time lag between budgeting funds (congressional appropriation), signing contracts and placing orders (obligations), receiving goods or services and making payments (liquidating obligations). Outlays, as used here, represent DOD's actual spending, rather than its authority to incur legally binding obligations or budget authority.

From FY2000 through FY2007, total defense outlays increased 200% (in current dollars), while Operation and Maintenance (O&M) spending increased by 231% (see **Table 3**). Fuel costs increased 497% during the same period, owing in large part to rapidly escalating crude oil prices. Stated in other terms, fuel costs represented 1.2% of DOD's spending in FY2000, and more than doubled to 3% by FY2008.

Table 3. DESC Fuel Costs vs. DOD Budget Authority & Outlay
(\$ billion)

	FY2000	FY2001	FY2002	FY2003	FY2004	FY2005	FY2006	FY2007	FY2008
BA	290.5	309.9	332.1	437.8	471.0	483.9	593.7	602.2	673.5
Outlay	294.5	308.5	332.1	387.3	436.5	474.2	499.3	529.1	594.6
O&M	105.9	112.0	114.7	151.4	174.0	188.1	203.8	216.6	244.8
Fuel Cost	3.6	4.2	4.1	5.6	6.8	8.8	11.5	11.5	17.9
% Outlay	1.2	1.4	1.2	1.4	1.5	1.9	2.3	2.2	3.0
% O&M	3.4	3.6	3.6	3.7	4.5	4.7	5.6	5.3	7.3

Source: National Defense Budget Estimates (Green Book) 2001-2010, <http://www.defenselink.mil/comptroller>, and Defense Energy Support Service, Fact Book (2000-2007).

Notes: BA—Budget Authority in Current Dollars. O&M—O&M Outlay.

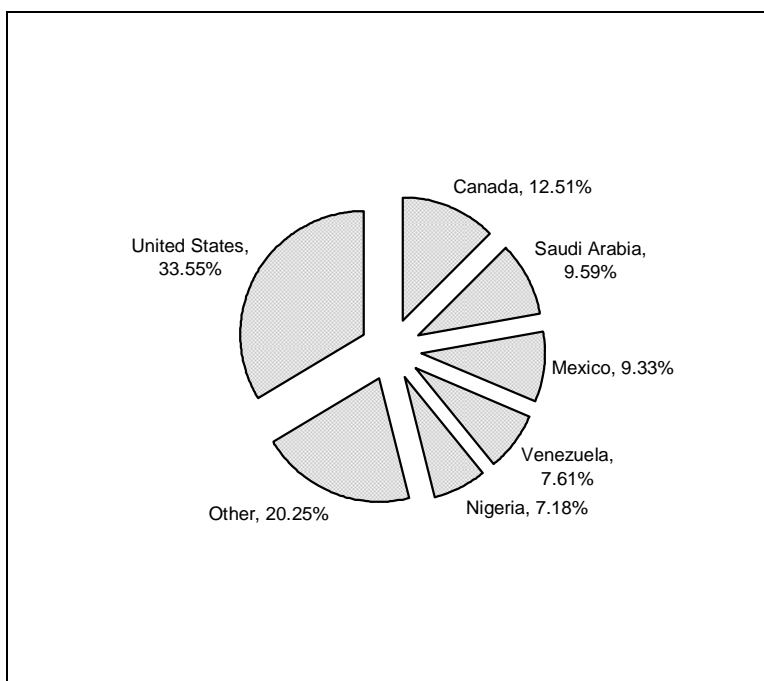
Refining, Suppliers, and the Crude Oil Supply

Crude Oil Supply

The U.S. produces roughly one-third of the crude oil it consumes annually with the balance supplied by Canada, Saudi Arabia, Mexico, Venezuela, Nigeria, and other smaller producers (**Figure 3**). A range of crude oils assays appears in **Table 4**. In the past, when U.S. crude oil production was higher than today, refineries could depend on steady supplies of light sweet (low sulfur) crude oil. The benchmark for this crude oil grade, West Texas Intermediate (WTI), is the reference for pricing of U.S. domestic crudes, as well as oil imports into the United States. With the diminishing supply of sweet crudes, refineries have increasingly turned to heavier sour crudes.

Figure 3. Crude Oil Supply 2007

Imported and U.S. Produced Crude Oil



Source: Energy Information Administration, U.S. Crude Oil Imports. http://tonto.eia.doe.gov/dnav/pet/pet_move_impqus_a2_nus_epc0_im0_mbb1_a.htm.

Table 4. Crude Oil Assays

Crude Oil	° API	%Sulfur	PPM Sulfur
West Texas Intermediate Crude Oil (a)	40	0.30	3,000
Alaska North Slope Crude Oil (a)	29.5 – 29	1.10	11,000
Strategic Petroleum Reserve sweet/sour (b)	40 – 30	0.5 – 2.0	5,000 – 20,000
NYMEX Deliverable Grade Sweet Crude Oil (c)	42 – 37	<0.42	4,200
Canadian Sweet/Sour (d)	37.7 – 37.5	0.42 – 0.56	4,200 – 5,600
Canadian Alberta Syncrude (d)	38.7	0.19	1,900
Saudi Arabia Arab Extra Light/ Heavy (d)	37.2 – 27.4	1.15 – 2.80	11,500 – 28,000
Mexico Maya/Olmeca (d)	39.8 – 22.2	0.80 – 3.30	8,000 – 33,000
Venezuela Tia Juana Light/Heavy (d)	31.8 – 18.2	1.16 – 2.24	11,600 – 22,400
Nigeria Bonny Light (c)	33.8	0.30	3,000

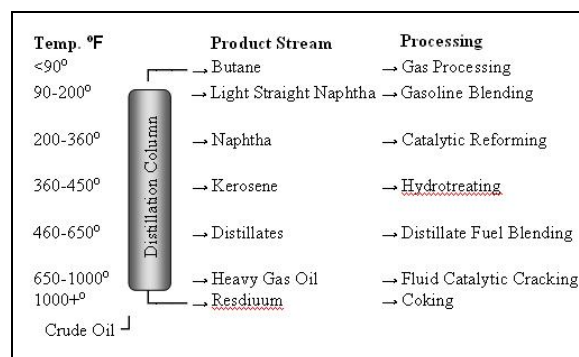
Source: (a) Platt's Oil Guide to Specifications, 1999. (b) Strategic Petroleum Reserve Crude Oil Assays http://www.spr.doe.gov/reports/Crude_Oil_Assays.htm (c) NYMEX, *Exchange Rulebook*, Light "Sweet" Crude Oil Futures Contract. http://www.nymex.com/rule_main.aspx?pg=63 (d) HPI Consultants <http://www.hpiconsultants.com/index.html>.

Notes: API – the American Petroleum Institute inverted gravity scale is used to express the 'lightness' or 'heaviness' of crude oils: light - greater than 30°; medium - 22° to 30°; heavy - less than 22°; and extra heavy - below 10°. Formula: $(141.5 \div \text{relative density of the crude [at } 15.5^{\circ}\text{C or } 60^{\circ}\text{F]}) - 131.5$.

Refining

Crude oil contains natural components in the boiling range of gasoline, kerosene/jet fuel and diesel fuel as shown in **Figure 4**. These products separate out in a refinery's atmospheric distillation tower. The term "straight-run" applies to the product streams that condense during this initial refining process. Many refineries now process the residuum that remains after atmospheric distillation into gasoline and middle distillate range products using heat and pressure, hydrogen, and catalysts (hydrocracking and catalytic cracking in refining terms).

Depending on their complexity, refineries may also produce kerosene/jet fuel and diesel fuel in this manner. As would be expected, specifications for jet fuel, particularly military grade, are more rigorous than for kerosene.⁵

Figure 4. Petroleum Products Boiling Range

Source: CRS

⁵ ASTM test method MIL-DTL-83133 is applied JP-8.

Generally, refineries are set up to run specific grades of crude oil, for example light sweet or heavy sour. Light sweet crude is particularly desirable as a feedstock for gasoline refining because its lighter-weight hydrocarbons make it easier to refine. Heavier crude oils require more complex processing than light crudes, and sour crudes require a desulfurization.

Refineries may be set up as:

- *Topping refineries* separate crude oil into its constituent petroleum products simply by distillation, also referred to as atmospheric distillation. A topping refinery produces naphtha but no gasoline.
- *Hydroskimming refineries* are equipped with atmospheric distillation, naphtha reforming and necessary processes to treat for sulfur. More complex than a topping refinery, hydroskimmers run light sweet crude and produce gasoline.
- *Cracking refineries* add vacuum distillation and catalytic cracking to run light sour crude to produce light and middle distillates;
- *Coking refineries* are high conversion refineries that add coking/resid destruction (delayed coking process) to run medium/sour crude oil.

A refinery's atmospheric distillation capacity sets the limit of its crude oil processing (usually expressed as barrels per calendar day or barrels per stream day). Catalytic cracking, coking, and other conversion units, referred to as secondary processing units, add to a refinery's complexity and can actually increase the volume of its output. Relative size, however, can be measured using refinery complexity—a concept developed by W.L. Nelson in the 1960s. The Nelson Complexity Index rates the proportion of secondary processes to primary distillation (topping) capacity.⁶ The index varies from about 2 for hydroskimming refineries to about 5 for cracking refineries, and over 9 for coking refineries.⁷ While the average index for U.S. refineries is 10, only 59 have coking capacity.

A typical refinery yields a limited supply of jet and diesel fuel yield depending on the type of crude oil processed. Gulf Coast (Texas and Louisiana) refineries with an average complexity of 12 to 13 may yield up to 8% jet fuel, and over 30% diesel as shown in **Figure 5**.⁸

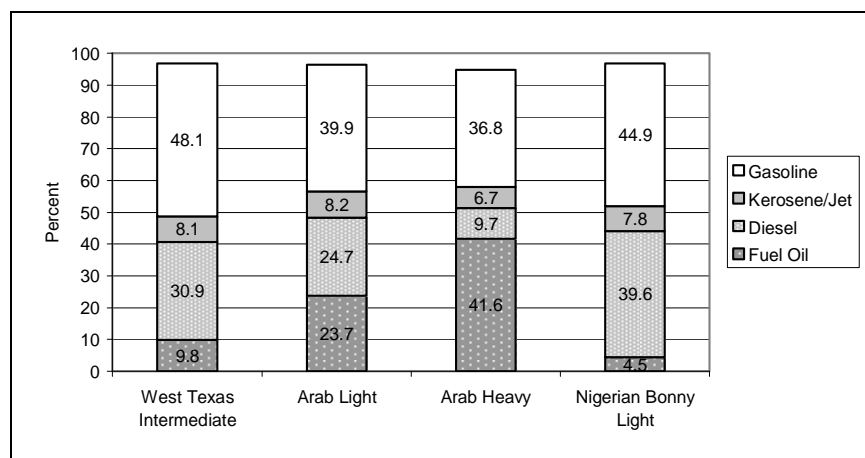
⁶ The index was developed by Wilbur L. Nelson in 1960 to originally quantify the relative costs of the components that constitute the refinery. Nelson assigned a factor of one to the primary distillation unit. All other units are rated in terms of their costs relative to the primary distillation unit also known as the atmospheric distillation unit.

⁷ Reliance Industries Limited, *Types of Refinery & Nelson's Complexity Index*, http://www.ril.com/html/business/types_refinery.html.

⁸ Complexity calculated by CRS based on NCI data published by the Oil and Gas Journal.

Figure 5. Yields of Typical Gulf Coast Refineries

Percent (%)



Source: Data used from Energy Intelligence, *The International Crude Oil Refining Handbook*, 2007
<http://www.energyintel.com>

Notes: Winter yields shown.

Sulfur Regulations

Changes in crude oil supplies have led some refineries to upgrade their processes (increasing their complexity) to handle heavier sour crude oils. At the same time, the Environmental Protection Agency (EPA) has taken action to reduce the sulfur content of diesel fuel. By the end of 2010, the sulfur content of all highway-use diesel fuel imported or produced in the United States will be limited to 15 parts-per-million (ppm) or 0.0015%; a fuel now termed “ultra-low sulfur diesel” (ULSD).⁹ The EPA regulations require measuring the sulfur content at the retail outlet, not the refinery. Petroleum product pipelines transport a variety of fuels; for example, a slug of gasoline followed by a slug of diesel fuel. To limit the additional sulfur picked up during pipeline transit, refiners are faced with producing even lower sulfur diesel fuel, or disposing of contaminated “transmix”—the interface between the slug of diesel and a higher sulfur-content product that preceded the diesel in the pipeline—by reprocessing.

In the late 1980s, DOD adopted the “single battlefield fuel” concept that envisioned using the same fuel for aircraft and ground equipment operating within a theater.¹⁰ DOD has steadily substituted JP-8 for diesel fuel in operating land-based equipment tactical vehicles and equipment. (This concept did not apply to naval operations or include carrier-based aircraft.) The quality of diesel fuel, particularly the sulfur content, varies significantly in other parts of the world. To minimize the length of the fuel supply chain to a theater of operation, the Army must rely on regionally supplied diesel fuel or JP-8, which can expose vehicles to fuel with elevated sulfur levels. The U.S. Army has adopted the American Society of Testing and Materials (ASTM) standard MIL-DTL-83133E for JP-8 that limits the maximum allowable sulfur content to 3,000 ppm, though a content of 140 ppm is typical. The sulfur content of most kerosene is currently 400

⁹ 40 C.F.R. § 80.510.

¹⁰ Office of the Secretary of Defense, *Directive 4140.43 Fuel Standardization*, 1988; supercede by *Directive 4140.25, DOD Management Policy for Energy Commodities and Related Services*, 2004.

ppm. EPA's "Guidelines for National Security Exemptions of Motor Vehicle Engines – Guidelines for Tactical Vehicle Engines" recognizes that tactical vehicles may need to operate on JP-8 or JP-5 fuel while in the United States to facilitate their readiness. EPA has not indicated that it will act on reducing the sulfur content of jet fuel.

Greenhouse Gas Regulations

In 2007, the United States Supreme Court ruled that EPA has the authority under the Clean Air Act to regulate carbon dioxide (CO₂) emissions from automobiles, and directed the EPA to conduct a thorough scientific review.¹¹ After the ordered review, EPA issued a proposed finding, in April 2009, that greenhouse gases contribute to air pollution that may endanger public health or welfare.¹² Though the finding pertained to automobile emissions, it has wide ranging implications. EPA recently proposed a Mandatory Reporting of Greenhouse Gases (GHGs) rule that would require petroleum refineries (among other industrial facilities) to report emissions from refining processes and all other sources located at the facility as defined in the rule.¹³ Petroleum refineries emit approximately 205 million metric tons CO₂ annually, which (according to the rule) represents approximately 3% of the U.S. GHG emissions. The cost of complying with the proposed could be minimal. However, the rule establishes the basis for future legislation and regulations that could cap GHG emissions from refineries as well as other industrial sources. Recently introduced bills (for example H.R. 2454 — The American Clean Energy and Security Act of 2009, which the House passed June 26, 2009) that would amend the Clean Air Act to establish a cap-and-trade system designed to reduce greenhouse gas emissions would cap emissions from refineries and allow trading of emissions permits ("allowances"). Over time, H.R. 2454's provisions would reduce the cap to 83%, forcing industries to reduce emissions by that amount or purchase allowances or offsets from others who would have reduced emissions more than required or who are not covered by the cap.

U.S. Refiners Supplying DOD Fuel

Currently, 142 refineries operate in the United States. The Energy Information Administration (EIA) reports their aggregate kerosene and jet fuel production (due to their overlapping boiling ranges) but does not break out production statistics by refinery.¹⁴ DESC does report refiners and suppliers that it awards contracts under its fuel solicitations. Between FY2003 and FY2008, DESC reported that its 4 top domestic suppliers included Shell, Valero Marketing and Supply Company, ExxonMobil, and BP Corporation (**Table 5**).

¹¹ *Massachusetts et al. v. Environmental Protection Agency*, 549 U.S. 497 (Supreme Court of the United States, April 2, 2007).

¹² The Proposed Endangerment and Cause or Contribute Findings for Greenhouse Gases under the Clean Air Act was signed on April 17, 2009. On April 24, 2009, the proposed rule was published in the Federal Register (www.regulations.gov) under Docket ID No. EPA-HQ-OAR-2009-0171.

¹³ Environmental Protection Agency, "Mandatory Reporting of Greenhouse Gases: Proposed Rule," 74 *Federal Register* 16539 - 16542, April 10, 2009.

¹⁴ EIA, <http://www.doe.eia.gov>.

Table 5. Top U.S. Fuel Suppliers to DOD FY2003 - FY2008

	Supplier	\$ million	%		Supplier	\$ million	%
FY2003	Exxon Mobil	729	13.6	FY2006	BP	1,190	9.2
	Shell	538	10.0		Exxon Mobil	1,178	9.1
	BP	442	8.2		Shell	1,151	8.9
	Valero	<u>314</u>	<u>5.8</u>		Valero	661	5.1
		2,023	37.6		Refinery Associates	<u>576</u>	<u>4.4</u>
						4,756	36.7
FY2004	Shell	1,068	17.2	FY2007	Shell	2,108	17.2
	BP	602	10.0		Valero	1,027	8.4
	Valero	334	5.5		Exxon Mobil	1,019	8.3
	Exxon Mobil	<u>275</u>	<u>4.5</u>		BP Corporation	<u>961</u>	<u>7.8</u>
		2,279	37.2			5,115	41.7
FY2005	BP	1,604	14.9	FY2008	Shell	1,715	12.1
	Exxon Mobil	1,024	9.5		BP	1,523	10.7
	Shell	1,004	9.3		Valero	1,044	7.4
	Valero	<u>564</u>	<u>5.2</u>		Exxon Mobil	<u>836</u>	<u>5.9</u>
		4,196	38.9			5,118	36.1

Source: DESC Fact Book (2003 – 2008).

Notes: U.S Suppliers shown.

Combined, the companies in **Table 5** operate 31 refineries in the United States (shown in **Table 6**), and represent nearly 6 million barrels per day of crude capacity. Not all may supply jet fuel to DOD, however. This suite of refineries averages 10 as rated by the Nelson Complexity Index. Two-thirds have the coking capacity needed to refine medium sour crude.

Table 6. U.S. Refineries Operated by Top Suppliers

Company	Location	St	Crude Capacity barrels/day	Nelson Complexity Index	Company	Location	St	Crude Capacity barrels/day	Nelson Complexity Index
Valero Energy Corp.	Krotz Springs	LA	83,100	2	BP PLC	Ferndale	WA	220,400	10
BP PLC	Kuparuk	AK	14,500	3	Valero Energy Corp.	Three Rivers	TX	96,000	10
Valero Energy Corp.	Denver	CO	28,000	6	Valero Energy Corp.	Ardmore	OK	87,877	10
Valero Energy Corp.	Corpus Christi	TX	205,000	7	BP PLC	Whiting	IN	399,000	11
Valero Energy Corp.	Norco	LA	186,000	7	ExxonMobil	Torrance	CA	149,500	11
Shell Chemical Co.	St. Rose	LA	55,000	7	ExxonMobil	Baytown	TX	563,000	12
BP PLC	Prudhoe Bay	AK	15,000	7	ExxonMobil	Chalmette	LA	188,000	12
BP PLC	Toledo	OH	147,250	8	ExxonMobil	Billings	MT	60,000	12
Shell Oil Products U.S.	Anacortes	WA	148,600	8	Valero Energy Corp.	Sunray	TX	166,660	13
Valero Energy Corp.	Paulsboro	NJ	166,000	8	ExxonMobil	Beaumont	TX	348,500	13
ExxonMobil	Baton Rouge	LA	501,000	9	Valero Energy Corp.	Benicia	CA	139,500	14
Shell Deer Park Refining Co.	Deer Park	TX	333,700	9	Valero Energy Corp.	Wilmington	CA	80,000	14
ExxonMobil	Joliet	IL	238,000	9	Shell Oil Products U.S.	Martinez	CA	157,600	14
BP PLC	Carson	CA	247,000	9	Shell Oil Products U.S.	Wilmington	CA	100,000	15
BP PLC	Texas City	TX	446,500	9	Valero Energy Corp.	Houston	TX	90,000	17
Valero Energy Corp.	Texas City	TX	225,000	9					
					Total/	Average		2,846,037	11.75

Source: Oil & Gas Journal. December 19, 2005.

Between 2000 and 2009, the number of refineries operating in the United States declined from 155 to 141.¹⁵ However, the atmospheric crude oil distillation capacity increased from 17.8 million to 18.6 million barrels per stream day (bpsd).¹⁶ The 1 million bpsd increase is due in part to increased diesel fuel capacity (now 3.5 million bpd). The downstream charge capacity for kerosene/jet fuel has averaged slightly over 1 million barrels per stream day.¹⁷ The median capacity of all currently operating refineries is roughly 80,000 bpd, and the 70 some refineries above the median capacity make up 85% of overall U.S. refining capacity.

¹⁵ U.S. DOE Energy Information Administration, *Petroleum Navigator*, Number and Capacity of Petroleum Refineries, http://tonto.eia.doe.gov/dnav/pet/pet_pnp_cap1_dcu_nus_a.htm.

¹⁶ Barrels per stream day: The maximum number of barrels of input that a distillation facility can process within a 24-hour period when running at full capacity under optimal crude and product slate conditions with no allowance for downtime.

¹⁷ Charge capacity: The input (feed) capacity of the refinery processing facilities.

Refinery Jet Fuel Yield and Supply

A typical refinery yields a limited supply of jet and diesel fuel depending on the type of crude oil processed. Gulf Coast refineries may yield up to 8% jet fuel, and over 30% diesel (see **Figure 5** above).

U.S. refineries produce roughly ten times more commercial jet fuel than military specification jet fuel, which has ranged from less than 50 to over 60 million barrels annually since 2000 (see **Table 7**).

Table 7. Military Use vs. Commercial Use Jet Fuel, and Total U.S. Refined Products

	Million Barrels per Year								
	2000	2001	2002	2003	2004	2005	2006	2007	2008
Military Jet	55.2	62.7	62.7	58.1	52.7	55.8	48.8	49.1	53.8
Commercial	<u>532.7</u>	<u>495.5</u>	<u>489.8</u>	<u>485.2</u>	<u>513.5</u>	<u>508.4</u>	<u>491.8</u>	<u>479.4</u>	<u>492.6</u>
Total Jet	587.9	557.5	552.5	543.3	566.2	564.2	540.6	528.5	546.4
All Refined Products	6,310.9	6,309.0	6,304.6	6,382.8	6,510.8	6,497.0	6,560.9	6,567.9	6,641.3

Source: U.S. Department of Energy EIA Petroleum Navigator - *U.S. Refinery Net Production*, http://tonto.eia.doe.gov/dnav/pet/pet_pnp_refp2_dc_nus_mbbbl_a.htm.

Notes: Mil – Military kerosene Jet fuel; Com – commercial jet fuel; All US – all US refined petroleum products.

Restating the data of **Table 7** in percentages, military jet fuel production ranges from 9% to 11% of the U.S. net production of jet fuel, but makes up less than 1% of all U.S. refined petroleum products (see **Table 8**).

Table 8. U.S. Refined Military Jet Fuel Percentage of U.S. Refined Jet Fuel and All U.S. Refined Products

	(%)								
	2000	2001	2002	2003	2004	2005	2006	2007	2008
Mil. Vs All Refined Jet Fuel	9.3%	11.2%	11.3%	10.7%	9.3%	9.9%	9.0%	9.3%	9.8%
Mil. Vs All Refined Products	0.9%	1.0%	1.0%	0.9%	0.8%	0.9%	0.7%	0.7%	0.8%

Source: Compiled from **Table 1** and **Table 7**.

DESC's worldwide jet fuel purchases have exceeded the U.S. refining industry's jet fuel output in recent years (see **Table 9**). In some years, U.S. refineries supplied less than 50% of DESC's jet fuel purchases. That is, the current capacity of U.S. refineries does not meet all of DOD's demand for military specification jet fuel. To make up the disparity, DESC has increased its purchase of commercial jet fuels, such as Jet A, which it upgrades to military specification. More recently, this strategy has reduced DESC's spending on fuel, as commercial jet fuel has priced lower (see retail kero-jet price curve in **Figure 2**).

Table 9. U.S. Refined Military Jet Fuel Vs. DESC Jet Fuel Purchases
(million barrels per year)

	2000	2001	2002	2003	2004	2005	2006	2007	2008
US Refined Military Spec Jet Fuel	55.2	62.7	62.7	58.1	52.7	55.8	48.8	49.1	53.8
DESC Military Jet Fuel Purchase	77.2	82.2	102.8	101.4	96.2	93.5	101.3	101.1	97.7
US % of DESC	71.5%	76.3%	61.0%	57.3%	54.8%	59.7%	48.2%	48.6%	55.1%

Source: Compiled from **Table 1** and **Table 7**.

Notes: “US % of DESC” represents the percentage of DESC jet fuel that the U.S. refineries supplies.

The lack of U.S. refining capacity does not necessarily compromise DOD’s fuel supply. A lengthy fuel supply chain that extends from the continental United States to forward operating areas (Iraq or Afghanistan, for example) is not desirable. Logistics demand that closer refineries supply the fuel. DESC makes up the balance of its purchases through contracts with foreign refineries and suppliers to support U.S. forces and installations outside the continental United States.

Fuel Acquisition

Originally, DOD’s authority to procure fuel extends from power originally granted to the Navy. Under 10 U.S.C. § 7229 (Purchase of Fuel), “... the Secretary of the Navy may, in any manner he considers proper, buy the kind of fuel that is best adapted to the purpose for which it is to be used.”¹⁸

Section 7229 superseded 34 U.S.C. 580 “which had been interpreted as authorizing the Armed Services Petroleum Purchasing Agency to negotiate contracts for the purchase of fuel, not only when acting as a procuring activity for the Navy, but also when filling the consolidated fuel requirements of the armed forces.”¹⁹ However, DESC now relies on the general procurement authority under 10 U.S.C. 2304 (Contract: competition requirement), since this gives DOD the authority to buy almost any kind of supply or service.

DESC awards contracts and purchases fuel in a one-step process under the Defense Working Capital Fund (DWCF). It internally transfers the fuel to DOD customers, which it refers to as “sales.” This operation permits the Department to take advantage of price breaks for large quantity purchases, and in most years provides the DOD customer a stabilized price for all products during that fiscal year.

¹⁸ Title 10—Armed Forces, Subtitle C—Navy and Marine Corps, Part IV—General Administration; Chapter 631—Secretary of the Navy: Miscellaneous Powers and Duties.

¹⁹ Title 34 – Navy was repealed generally by an act of August 10, 1956, which revised and codified the statutory provisions that related to the Army, Navy, Air Force, and Marine Corps, and enacted those provisions into law as Title 10, Armed Forces. 70 Stat. 1126. Public Law 1028 Chapter 1041, 70A Stat. 1.

Acquisition Regulations

The term “acquisition,” as defined by Title 41 (Public Contracts) U.S.C. Section 403, means the process of acquiring, with appropriated funds, by contract for purchase or lease, property or services that support the missions and goals of an executive agency. The term “procurement” includes all stages of the process of acquiring property or services, beginning with the process for determining a need for property or services and ending with contract completion and closeout. Title 10 U.S.C. Chapter 137 – Procurement codifies general military laws governing the Armed Forces acquisition process.

The primary document for federal agency acquisition regulations consists of the Federal Acquisition Regulation (FAR), as promulgated in Title 48 Code of Federal Regulations (CFR) – *The Federal Acquisition Regulations System*.²⁰ The FAR System does not include internal agency guidance, however. DOD has promulgated the Defense Acquisition Regulation System (DFARS) in 48 CFR Parts 201 through 299.

Multiyear Contracting Authority

In practice, DESC has typically awarded one-year bulk-fuel contracts and multi-year direct delivery fuel contracts. DESC uses fixed-price contracts with an economic price adjustment that provides for upward and downward revision of the stated contract price upon the occurrence of specified contingencies.²¹ Generally, these types of contracts use the clauses at FAR 52.216–2, Economic Price Adjustment—Standard Supplies.²² DESC uses economic price adjustment provisions in contracts when general economic factors make the estimation of future costs too unpredictable, as is typically the case for refined petroleum products.²³

DESC has determined supplies and related services are eligible for the multi-year contracting provisions under FAR 17.105-1(b) and DFARS 217.170(a) and 217.172(b). DESC adopted contracting instructions for entering into multiyear contracts for bulk petroleum, ships’ bunker, into-plane, and post-camp-and-station for the interim period of October 1, 2008, through September 30, 2009.²⁴ DOD and the military departments are authorized to enter initial five-year contracts for storage, handling, or distribution of liquid fuels or natural gas under 10 U.S.C §2922. These contracts may contain options for up to three five-year renewals, but not for more than a total of twenty years.

“Multiyear contract” means a contract for the purchase of supplies or services for more than one, but not more than five, program years. A multiyear contract may provide that performance under the contract during the second and subsequent years of the contract is contingent upon the appropriation of funds, and (if it does so provide) may provide for a cancellation payment to the

²⁰ P.L. 93-400 Office of Federal Procurement Policy Act of 1974 as amended by P.L. 96-83 Office of Federal Procurement Policy Act Amendments of 1979. Federal Acquisition Regulations are available at <http://farsite.hill.af.mil/VFDFARA.HTM>.

²¹ See 48 C.F.R. § 16.203—Fixed-price contracts with economic price adjustment, and 48 C.F.R. § 216.203-4—Contract Clauses.

²² http://www.acqnet.gov/far/current/html/52_216.html#wp1114622

²³ See DFARS PGI 216_2 – Fixed Price Contracts. http://farsite.hill.af.mil/reghtml/regs/far2afmcfars/fardfars/dfars/PGI%20216_2.htm#TopOfPage

²⁴ Contracting Instruction (CI): 08-12 Multiyear Determination and Findings. <http://www/desc/dla/mil>.

contractor if Congress does not appropriate funds. The key difference between a *multiyear* contract and a *multiple year* contract is that *multiyear* contracts buy more than one year's requirement (of a product or service) without establishing and having to exercise an option for each program year after the first, whereas *multiple year* contracts have a term of more than one year regardless of fiscal year funding.²⁵

Multiyear contract authority for supplies derives from the general procurement statutes for acquisition of property under 10 U.S.C. 2306b (Multiyear contracts: acquisition of property). DOD agencies, as regulated under 48 CFR 17.172 (Multiyear Contract for Supplies), may enter into multiyear contracts for supplies if the use of such contracts will promote national security.

DOD may enter into a multiyear contract for supplies if the contract will result in substantial savings of the total estimated costs of carrying out the program through annual contracts (48 CFR 17.105-Uses). If Congress does not appropriate funds to support the succeeding years' requirements, the agency must cancel the contract. Multiyear contracting is encouraged in order to take advantage of lower costs, among other objectives under 48 CFR 17.105-2 (Objectives).

A multiyear contract for supplies, in addition to the conditions listed in FAR 17.105-1(b), can be entered into if the contract will promote the national security of the United States (10 U.S.C. § 2306b (a) (6)) and promulgated in 48 CFR 217.172 - Multiyear contracts for supplies). The multiyear contract cannot exceed \$500 million (when entered into or when extended) until the Secretary of Defense identifies the contract and any extension in a report submitted to the congressional defense committees.

Acquisition of Alternative Fuels

DOD is authorized to procure fuel derived from coal, oil shale, and tar sands under 10 U.S.C. § 2922d. This also includes a direct authority for multi-year contracts. Contracts for procurement of these fuels "may be for one or more years at the election of the Secretary of Defense."

The Secretary of Defense has broad waiver authority over acquisition of alternative fuels. If the Secretary determines that market conditions will adversely affect DOD's acquisition for a certain defined fuel source, the Secretary may waive any provision of law prescribing the formation of contracts, prescribing terms and conditions to be included in contracts, or regulating the performance of contracts. The term "defined fuel source" means petroleum (which includes natural or synthetic crude, blends of natural or synthetic crude, and products refined or derived from natural or synthetic crude or from such blends), natural gas, coal, and coke. The five-year limit on multi-year contracts would be a "term and condition" which could be waived upon the requisite finding of the Secretary. DESC has not determined whether it could or would want to waive statutory limits on multiyear contracts, as it is not clear to DESC that either DDO or Congress would agree with exercising the waiver authority for this purpose.²⁶ DESC has not wanted to take the chance of jeopardizing the delegation or losing the sales authority granted under 10 U.S.C. § 2922e by taking this position.

²⁵ See FAR Subpart 22.10—Service Contract Act of 1965, as Amended.

²⁶ Personal communication with Dianne M. Smith-Neff, Defense Logistics Agency, July 7, 2009.

Fully Burdened Cost of Fuel

DESC bases contract delivery price on the “lowest laid down cost” to the government. A typical delivery point, a Defense Fuel Supply Point (government owned or leased tank farms), redistributes fuel to bases and installations. DESC levels the price of fuel for all DOD’s “customers” and includes a surcharge for its operating costs. While DESC’s contract may specify the final destination, an additional cost may be incurred by the operational command that tactically delivers the fuel forward — for example, air-to-air refueling, underway replenishment, or ground transport. In the past, DOD had not factored these hidden costs into fuel costs.

The Duncan Hunter National Defense Authorization Act for FY2009 (P.L. 110-417) now requires that analyses and force planning processes consider the requirements for, and vulnerability of, fuel logistics.²⁷ By making fuel logistics part of the acquisition processes, new military capabilities must take a life-cycle cost analysis into account that includes the fully burdened cost of fuel. The act also directs the appointment of a director responsible for the oversight of energy required for training, moving, and sustaining military forces and weapons platforms for military operations.²⁸

Policy Considerations

Over the current decade, which saw an unprecedented spike in crude oil prices, DOD experienced a 500% increase in the cost of fuel cost (dollars per barrel). The concern over declining worldwide crude oil production had preceded rising fuel costs also for several years. In 2006, due to increasing fuel costs and military operations in Iraq and Afghanistan, the Air Force had to reduce funding available for flying hours used to train Air Combat Command aircrews.²⁹

Fuel costs have represented as much as 3% of DOD’s spending and over 7% of the Operation and Maintenance budget in the past decade. In comparison, the airline industry’s major operating costs are fuel. However, the airline industry has the option during periods of high fuel cost of passing the costs on to customers, adjusting flight schedules, withholding stock dividends, or even declaring insolvency. Unlike the airlines, DOD’s only recourse has been to request supplemental appropriations to pay for the increased costs and supplies. For example, DOD identified \$0.5 billion in the FY2007 Emergency Supplemental Request for increases in baseline fuel costs resulting from higher market costs in the first half of FY2007.³⁰ DOD has looked at several options to limit its vulnerability to fuel price swings and supply shortages. These include “fuel hedging,” multi-year contracting, and alternate fuels. In particular, increasing purchases of more widely available commercial Jet A fuel have not only reduced DOD’s fuel costs but have expanded the range of supplies — an arguable goal for an alternative fuel.

²⁷ Section 332. Consideration of Fuel Logistics Support Requirements in Planning, Requirements Development, And Acquisition Processes.

²⁸ Section 902. Director of Operational Energy Plans and Programs.

²⁹ Tech. Sgt. Russel Wicke, “Rising Fuel costs tighten Air Force belt,” *Air Force Link*, September 9, 2006, <http://www.af.mil/news/story.asp?id=123026679>.

³⁰ Office of the Secretary of Defense, *Operation and Maintenance Overview Fiscal year (FY) 2008 Budget Estimates*, February 2007, p. 196, http://www.defenselink.mil/comptroller/Docs/fy2008_OandM_overview.pdf.

DESC's "business model" provides the flexibility needed to meet changing operational requirements from year-to-year. As noted above, DESC uses fixed-price contracts that include an economic price adjustment clause that provides for upward and downward price revisions. DESC has designed this contract provision to take advantage of swings in fuel prices, which ultimately reflect crude oil prices. If prices decline, DESC's costs decline. If prices rise, the economic clause adjusts the price that DESC would pay to the going market rate. This limits DESC's risk in holding contracts for fuel priced above the going market rate, but does not hold down costs during rapidly escalating prices. (DESC will pay higher prices, but look for the best offer.)

A practice used in the airline industry makes use of various "hedging" strategies to minimize the risk of future jet fuel price increases. A simple hedge involves buying "futures" contracts to lock in prices. For example, when crude oil prices peaked at nearly \$147 per barrel in the summer of 2008, Southwest Airlines reportedly had managed earlier to hedge its fuel at \$51/barrel.³¹ In 2004, the Defense Business Board convened the Fuel Hedging Task Group to examine potential ways of reducing DOD's exposure to fuel price volatility by hedging in commercial markets.³² Although the Board Task Group concluded that DOD could feasibly hedge its fuel purchases, it gave broader support to engaging in "no-market" hedging through the Department of the Interior's Mineral Management Service. During crude oil price spikes, additional Interior Department oil could apply lease revenues to offset increasing DOD fuel costs.³³ The Group concluded that DOD could request that the Office of Management and Budget (OMB) seek legislative authority to transfer funds from Interior to Defense, or vice versa; depending on which Department benefits from unanticipated price changes. However, Interior derives the bulk of its revenues from Outer Continental Shelf (OCS) leases, and Congress has already statutorily allocated those revenues among various government accounts, including coastal states. Furthermore, OCS lessees pay royalties-in-kind, in the form of oil delivered to the Strategic Petroleum Reserve (SPR).³⁴

Congress created the SPR as a response to the 1970s Arab oil embargo to prevent a reoccurrence of supply disruptions. When filled to its 727 million barrel capacity, the SPR represents roughly 70 days of imported supply. A drawdown of the SPR under the Energy Policy and Conservation Act (EPCA – P.L. 94-163) can take the form of a sale to the highest bidder (42 U.S.C. § 6241), or an exchange (the company receiving the oil must later replace it with a comparably valued volume). During the opening days of the 1991 Persian Gulf War, President George H.W. Bush's drawdown authorization precipitated a rapid crude oil price decline.

The Government Accountability Office (GAO) reported that in 2006, 40% of the crude oil refined in U.S. refineries was heavier than that stored in the SPR.³⁵ Refineries that process heavy oil cannot operate at normal capacity if they run lighter oils. The types of oil currently stored in the SPR would not be fully compatible with 36 of the 74 refineries considered vulnerable to supply disruptions. GAO cited a DOE estimate that U.S. refining throughput would decrease by 735,000

³¹ Dan Reed, "Can fuel hedges keep Southwest in the money?," *USA Today*, July 7, 2008. http://www.usatoday.com/money/industries/travel/2008-07-23-southwest-jet-fuel_N.htm.

³² Fuel Hedging Task Group, *Recommendations related to the practical use of fuel hedging for the Department of Defense*, Defense Business Board, March 1, 2004, <http://www.defenselink.mil/dbb/pdf/FuelHedging-03-2004.pdf>.

³³ CRS Report RL33493, *Outer Continental Shelf: Debate Over Oil and Gas Leasing and Revenue Sharing*, by Marc Humphries.

³⁴ See CRS Report RL33341, *The Strategic Petroleum Reserve: History, Perspectives, and Issues*, by Robert Bamberger.

³⁵ U.S. Government Accountability Office, *Strategic Petroleum Reserve - Options to Improve the Cost-Effectiveness of Filling the Reserve*, GAO-08-512T, February 26, 2008, p. 5, <http://www.gao.gov/new.items/d08521t.pdf>.

barrels per day (or 5%) if the 36 refineries had to use SPR oil—a substantial reduction in the SPR’s effectiveness during an oil disruption, especially if the disruption involved heavy oil.

The SPR does not have a defined role in mitigating a DOD fuel supply disruption.³⁶ Presumably, a refinery under contract to supply DOD would have the option of bidding on a drawdown sale. A typical refinery yields only 8% jet fuel on average. That is, for every gallon of jet fuel a refinery yields, it also produces roughly 11.5 gallons of other petroleum products (gasoline, diesel). This operational limitation on producing jet fuel limits the SPR’s role during a supply disruption, if the only objective is supporting DOD’s requirement.

As a final recourse, DOD may look to an alternative or replacement for crude oil, as provided in the 2005 Energy Policy Act. However, the Energy Independence and Security Act of 2007 (P.L. 110-140) prohibits federal agencies from procuring alternative or synthetic fuels, unless contract provisions stipulate that life-cycle greenhouse gas emissions do not exceed equivalent conventional fuel emissions produced from conventional petroleum sources.³⁷ The provision was included to ensure that federal agencies are not spending taxpayer dollars on new fuel sources that will exacerbate global warming—a response to proposals under Air Force consideration to develop coal-to-liquid (CTL) fuels.³⁸ The Air Force has since abandoned plans to attract private investment in a CTL fuel plant to supply Malmstrom Air Force Base, Montana, but DESC is interested in pursuing a pilot program for synthetic fuels to support DOD JP-8 fuel requirements in Alaska.³⁹

Although crude oil prices have precipitously declined, as of late, the reoccurrence of crude oil supply shortages and price spikes may be inevitable. Both policy and economics keep fossil-based alternatives out-of-reach for now. Confronted with the same realities facing all energy consumers, DOD is shifting its thinking toward efficiency. DOD might better inform Congress by reporting on the fully burdened cost of fuel for military operations and contingencies.

Another potential concern for Congress may be the refining sector’s lack of responsiveness to DOD’s procurement announcements when periods of high petroleum prices make the demands of commercial-sector more profitable. In response to proposed greenhouse gas emission caps, refinery operators may question whether the value of emission credits outweighs the continued operation of marginally profitable refineries. In the long term, Congress may be concerned whether some operators may shut down their refineries and if such actions might reduce the number of defense fuel suppliers.

³⁶ Under 42 U.S.C. § 6241 (g) *Directive to carry out test drawdown and sale*, the Secretary of Defense must determine that a test drawdown would not impair national security.

³⁷ Section 526 - *Procurement and Acquisition of Alternative Fuels*.

³⁸ See Letter of March 17, 2008, from Chairman, House Committee on Oversight and Government Reform to Chairman, Senate Committee on Energy and Natural Resources.

³⁹ DESC News Release, February 2, 2009. https://www.desc.dla.mil/DCM/Files/Registration%20Release_2009022009.pdf

For Further Reading

For background on alternative fuel sources, see

- CRS Report RL34133, *Fischer-Tropsch Fuels from Coal, Natural Gas, and Biomass: Background and Policy*.
- CRS Report RL33359, *Oil Shale: History, Incentives, and Policy*.

For background information on greenhouse gas legislation and the cap-and-trade system, see

- CRS Report R40643, *Greenhouse Gas Legislation: Summary and Analysis of H.R. 2454 as Passed by the House of Representative*.

Appendix. Terms

Avgas (aviation gasoline) is a high octane fuel used in light aircraft powered by reciprocating spark-ignition engines.

Crude Oil Classification

API		Sweet	Sulfur	Sour
Gravity		0.0% - 0.5%	Medium Sour 0.5% - 1.5%	1.5% - 3.0+%
40°	Light	West Texas Interm.		
33°	Medium	Bonny Medium	Mexico Olmeca	Arab Light
22°	Heavy			Venezuela Heavy

DFM (diesel fuel marine) has been used in all shipboard propulsion plants (diesel, gas turbine, and steam-boiler) since 1975. Its NATO equivalent is F-76.

DF2 (No. 2 diesel fuel) is the primary fuel for ground mobility vehicles.

FSII stands for Fuel Systems Icing Inhibitor

FOB (free on board) is a trade term requiring the seller to deliver goods on board a vessel designated by the buyer.⁴⁰ The seller fulfills its obligations to deliver when the goods have passed over the ship's rail. When used in trade terms, the word "free" means the seller has an obligation to deliver goods to a named place for transfer to a carrier. Contracts involving international transportation often contain abbreviated trade terms that describe matters such as the time and place of delivery and payment, when the risk of loss shifts from the seller to the buyer, as well as who pays the costs of freight and insurance.

Jet A-1 (JA1) is a civilian-aviation kerosene-based turbine fuel adopted by international commercial aviation. Its ASTM specification is D16555 (Jet A-1), and identified by NATO as F-35. Jet A, normally available in the United States has the same flash point (100 °F) as JET A-1 but a higher freeze point.

Jet A (JA) is civilian-aviation kerosene type of jet fuel (similar to JA-1), produced to an ASTM specification and normally only available in the United States. It has the same flash point as Jet A-1 but a higher freeze point maximum (-40°C). It is supplied under ASTM D1655 (Jet A) specification.

Jet B is a distillate covering the naphtha and kerosene fractions. It can be used as an alternative to Jet A-1 but because it is more difficult to handle (higher flammability), there is only significant demand in very cold climates where its better cold weather performance is important. It is supplied in Canada under Canadian Specification is CAN/CGSB 3.23.

⁴⁰ Forbes Investopedia, <http://www.investopedia.com/terms/f/fob.asp>.

JP-4 (JP for “jet propellant”) is the military equivalent of Jet B with the addition of corrosion inhibitor and anti-icing additives; it meets the requirements of the U.S. Military Specification MIL-DTL-5624U Grade JP-4. (As of January 5, 2004, JP-4 and 5 meet the same U.S. Military Specification). JP-4 also meets the requirements of the British Specification DEF STAN 91-88 AVTAG/FSII (formerly DERD 2454). Its NATO Code is F-40.

JP-5 is a fuel developed for use in military aircraft stationed aboard aircraft carriers where the risk of fire is a great concern, particularly in the confined spaces of the hanger deck. It is kerosene-based, and has a relatively higher flash-point (140 °F) than other aviation turbine fuels (Jet A-1 and JP-8). Its specification is MIL-DTL-5624 U. Its NATO code is F-44. JP-5 is also suitable for use as ship turbine fuel.

JP-8 is the military equivalent of Jet A-1 but with corrosion inhibitors and icing inhibitors. The Air Force switched to JP-8 in 1996 out of concerns for safety and combat survivability. It is a less flammable and a less hazardous fuel than the previously used naphtha-based JP-4. (The Alaska Air Guard still relies on JP-4 for its cold-climate properties.) Though JP-8 contains less benzene (a carcinogen) and less n-hexane (a neurotoxin) than JP-4, it has a stronger smell and is oily to the touch, whereas JP-4 is more solvent-like. Its ASTM specification is MIL-DTL-83133, and is identified by NATIO as F-34. JP-8+100 includes an additive that increases thermal stability. JP-8 has also been adopted for use in diesel-powered tactical ground vehicles.

Middle Distillate range fuels include kerosene, jet fuel, and diesel fuel.

Military installation means a base, camp, post, station, yard, center, or other activity under the jurisdiction of the Secretary of a military department or, in the case of an activity in a foreign country, under the operational control of the Secretary of a military department or the Secretary of Defense (10 U.S.C. 2801(c)(2)).

Mogas (motor gasoline) is the primary fuel for non-tactical ground vehicles.

Multiyear contracting is a special contracting method to acquire known requirements in quantities and total cost not over planned requirements for up to five years unless otherwise authorized by statute, even though the total funds ultimately to be obligated may not be available at the time of contract award (48 CFR 17.104 General) . This method may be used in sealed bidding or contracting by negotiation. Agency funding of multiyear contracts must conform to OMB Circulars A-11 (Preparation and Submission of Budget Estimates) and A-34 (Instructions on Budget Execution).

Naphtha is a petroleum distillate with a boiling range between gasoline and heavier benzene. It is used as a feedstock in gasoline production where it is catalytically reformed from a lower to a higher octane product termed reformate.

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